REMARKS

Claims 1, 2, 4 and 12-17 are currently pending. Claims 3, 5-11 and 18-19 have been cancelled. Claim 1 has been amended to incorporate the limitations of claim 11. Applicants respectfully submit that no new matter has been added.

Claims 1-19 currently stand rejected for various reasons. Claims 18 and 19 stand rejected under 35 U.S.C. § 102 (b) as anticipated by, or in the alternative under 35 U.S.C. § 103 (a) as obvious over Yang, TAPPI J., Vol. 76, No. 7 (hereinafter "Yang"). Claims 1, 2, 4, 11-14, 16, 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,851,351 (hereinafter "Baecker") in view of Yang. Claims 15 and 17 stand rejected under 35 USC § 103(a) over Baecker in view of Yang and Akhtar, U.S. Patent No. 5,620,564 (hereinafter the "564 patent"). Applicant respectfully traverses these rejections for at least the following reasons.

Rejections under 35 USC §102(b)

Claims 18 and 19 stand rejected under 35 USC § 102(b) as being anticipated by the Yang reference. Applicants respectfully submit that this rejection has been rendered moot by the cancellation of claims 18 and 19.

Rejections under 35 USC § 103(a)

Claims 1, 2, 4, 11-14, 16, 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Baecker in view of Yang. Claims 15 and 17 stand rejected under 35 USC § 103(a) over Baecker in view of Yang and the '564 Patent. The Manual of Patent Examining Procedure ("MPEP") sets forth that:

> "To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure." See MPEP § 2143.

Applicants respectfully submit that the Office Action has failed to set forth a *prima facie* case of obviousness as all the requirements for a *prima facie* case have not been met.

Claims 1, 2, 4 and 12-17 relate to the biokraft pulping methods of eucalyptus wood. Claim 1 of the present invention, as amended, reads as follows:

> " A method for producing paper pulp for use in the making of paper from eucalyptus wood chips, comprising in the steps of:
>
> a) inoculating the wood chips with white rot fungus which is *Phanerochaete chrysosporium*;
>
> b) fermenting the wood chips so as to cause a propagation of the fungus through the wood chips and allow the fungus to modify lignin; and
>
> c) pulping of the degraded wood chips by a known kraft process." See claim 1.

Claims 2, 4 and 12-17 depend directly or indirectly from claim 1 and therefore contain all of the limitations of claim 1. Claims 2, 4 and 12-17, therefore, all contain the limitation of a "method for producing paper pulp...from eucalyptus wood chips"

1. General knowledge of one skilled in the art does not provide a sufficient motivation to modify or combine the Yang reference, the Baecker patent or the '564 patent to teach the biokraft pulping of eucalyptus wood.

Of the cited references, only the Baecker patent and the '564 patent teach or suggest any methods of biopulping. None of these references disclose the use of eucalyptus wood or the use of a kraft pulping process for biotreated wood.

The Baecker patent is directed towards a method for the "microbial pretreatment of woodchips to be transported by ship" (see col. 2., lines 6-7, of the Baecker patent). The reference contains no disclosure of the use of eucalyptus wood or the kraft pulping process. While the reference does disclose that "any pretreatment occurring will effectively result in cost savings" (see col. 3, lines 4-5, of the Baecker patent), the reference does not disclose what any such cost savings would be in relation to the quality of paper produced. In his Declaration Dr. Akhtar states that:

> "While a certain amount is known about the interaction of lignin and cellulose in wood fibers, because of the extreme complexity of the relationships, and the variation in the enzymes produced by varieties of the white-rot fungi, it is not readily possible to predict from the action of a given fungus on a given type of wood whether or not the paper made from wood partially digested with such fungus will have desirable qualities or not. The selection of white-rot fungi for biopulping applications on the basis of selective lignin degradation may seem a rational one, but it has proven to be a poor predictor of the quality of the resultant paper. The exact relationship between the degradation of lignin, and the resulting desirable qualities of paper produced at the end of the pulping process, are not at all clear. Accordingly, given present standards of technology and the present understanding of the complex interaction of lignin and cellulose, it is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of any energy savings achieved through such a process." (See paragraph 9 of the Akhtar Declaration).

Dr. Akhtar further states that:

> "..as the nature of the white rot fungus-lignin relationship is not predictable, the teaching of biopulping methods utilizing white rot fungus with non-eucalyptus wood, would not suggest to one skilled in the art that the same methods and fungus species would necessarily be useful in the biopulping of a different species of wood." (See paragraph 11 of the Akhtar Declaration)

As the nature of the biopulping art is unpredictable as to the qualities of the paper produced using such process when different species of fungi and wood are used, and as the Baecker contains no teaching or suggestion of the use of eucalyptus wood or a kraft pulping process, Applicants respectfully submit that a person skilled in the art would not have sufficient motivation to modify the teachings of the Baecker patent to use eucalyptus wood and a kraft process as set forth in the claims of the present invention.

The '564 patent is directed at a method of biopulping loblolly pine and aspen. The reference specifically discloses that "mechanical pulping" is the preferred process for pulping the biotreated wood chips disclosed. (See col. 8, line 20 of the '564 patent). While the reference states that "many pulping methods are suitable" for the pulping of biotreated wood chips (See col. 8, lines 18-19 of the '564 patent), the reference does not disclose that kraft pulping is one of these "many methods". The fact that the '564 patent states that kraft pulping is a common pulping process (See col. 1, lines 25 of the '564 patent) and that biopulping has been shown to have efficacy "with both soft wood and hardwood" (See col. 3, lines 48-50 of the '564 patent) is not the same as teaching that biokraft pulping of eucalyptus would produce paper "which has a

higher strength than that made from purely kraft pulping process." (See page 5 lines 24-25 of the specification). As Dr. Akhtar pointed out in his Declaration, the nature of the white rot fungus-lignin relationship is not predictable. The teaching of biopulping methods utilizing white rot fungus with one species of wood would not suggest to one skilled in the art that the same methods and fungus species would necessarily be useful in the biopulping of a different species of wood. It is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of any energy savings achieved through such a process. (See paragraphs 9 and 11 of the Akhtar Declaration).

The Yang reference is directed towards the bleaching of eucalyptus kraft pulp using an EnZone process (see summary of Yang). The Yang reference contains no teaching or suggestions of any biological treatment of wood chips prior to the kraft pulping of wood. The Examiner has stated that "it would have been obvious to the routineer to use the hard wood eucalyptus of Yang when making the Kraft pulp of Baecker." Applicants respectfully disagree with this assertion.

First, the Yang Reference contains no disclosure or suggestion of any biopulping process. Additionally, the Baecker Patent contains no teaching or suggestion of the use of eucalyptus wood or the specific use of a kraft pulping process. Given the unpredictable nature of the paper quality and energy savings of biopulping procedures using different fungi species, wood species and pulping procedures as delineated above and discussed in paragraphs 9 and 11 of the Akhtar Declaration, one of ordinary skill in the art would not have the motivation to combine the teaching of the Yang reference and the Baecker patent and the '564 Patent with the expectation of producing paper of high quality for a lower energy cost.

Second, even if one were to assume, solely for the purposes of argument, that the art provides motivation to combine the references, given the knowledge of one skilled in art, one would find that the prior art does not suggest a reasonable expectation of success. The Baecker patent and the '564 patent only specifically disclose the biopulping of loblolly pine and aspen wood. If these references were to suggest any biokraft pulping process, it would be a processes using loblolly pine and aspen. However, when Applicants attempted biokraft pulping with loblolly pine and aspen, the results showed no advantage of using fungus-treated chips over

control chips (non-fungus-treated chips) in terms of paper quality or energy savings. No significant difference was shown in the strength and optical properties of such biokraft pulp paper over regular paper produced from standard kraft pulps of loblolly pine and aspen. (See paragraph 16, and Exhibits B and C if the Akhtar Declaration). Given such results, one skilled in the art would not find sufficient motivation to combine the references of Yang with the Baecker Patent or the '564 Patent, with a reasonable expectation of success given the lack of teaching of the references.

Finally, Applicants respectfully submit that, at the most, it would have been "obvious to try" to use eucalyptus wood in a biokraft pulping procedure in view of the combined teachings of the Baecker patent, the Yang reference and the '564 patent. Such "obvious to try" situations are where "a general disclosure may pique the scientist's curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient teaching of how to obtain the desired result, or that the claimed result would be obtained if certain directions were pursued." *In re Eli Lilly & Co.*, 902 F.2d 943, 945, 14 USPQ2d 1741, 1743 (Fed. Cir. 1990). It is well noted, however, that "'obvious to try' is not the standard under § 103." *In re O'Farrell*, 853 F.2d 894, 903, 7 USPQ2d 1673, 1680 (Fed. Cir. 1988).

In view of the above, Applicants respectfully submit that a *prima facie* case of obviousness of claims 1, 2, 4 and 12-17, after amendment herein, has not been established. Therefore, Applicants respectfully request the withdrawal of the rejection of all the present pending claims under 35 USC § 103(a).

2. Failure of cited references to disclose the biokraft pulping of eucalyptus without the addition of nutrients.

Claim 12 contains the limitation that "the wood chips are inoculated with the fungus and without nutrients."

Of all the cited prior art references, only the Baecker patent and the '564 patent contain any teaching or suggestion of biopulping methods. Both of these references, however, teach the addition of nutrient adjuvants during the biopulping process.

The Baecker patent teaches the use of added nutrients in its biopulping process. The Baecker patent teaches "In addition to the fungal spores, a readily usable carbohydrate source and other nutrients in the form of trace elements that can stimulate incubation of the spores and subsequent fungal growth and ligninolytic and hemicellulolytic activities are incorporated in the water sprayed onto the wood chips". (See col. 4, lines 3-8 of the Baecker patent).

The '564 patent discloses that "The present invention requires the addition of a nutrient adjuvant to the biopulping procedure described above. Preferably, an amount of the nutrient adjuvant is added to the fungal inoculum prior to the addition of the inoculum to the woods chips". (See col. 5, lines 8-12 of the '564 patent).

The Yang Reference contains no teaching or suggestion of any biopulping method, let alone a method without the use of additional nutrients.

As none of the cited references disclose a method of pulping paper without the addition of nutrients, the cited references fail to teach or suggest all of the limitations of claim 12. Claim 12, therefore, is not rendered obvious by the cited references.

3. Surprising and Unexpected Results

Applicants submit that even if a case of *prima facie* obviousness can be made, the unexpected results of the present invention rebut such a finding. Evidence of surprising and unexpected results can be sufficient to rebut a *prima facie* case of obviousness, under 35 U.S.C. § 103(a). The Manual of Patent Examining Procedures states that:

> "Greater than expected results are evidence of nonobviousness. 'A greater than expected result is an evidentiary factor pertinent to the legal conclusion of obviousness ... of the claims at issue.' In re Corkill, 711 F.2d 1496, 226 USPQ 1005 (Fed. Cir. 1985)." MPEP § 716.02(a).

Applicants respectfully submit that surprising and unexpected results are established by evidence presented in the specification, as well as by additional evidence of the surprising and unexpected nature of the results presented in the Akhtar Declaration. Applicants submit that the specification of the present application contains results from well-controlled experiments which clearly demonstrate that paper produced according to the methods of the present invention, or

from the biotreated eucalyptus wood chips of the present invention, has properties which would have been surprising and unexpected to one of ordinary skill in the art at the time the invention was made. Specifically, paper produced according to the methods of the present invention, or using chips of the present invention, possesses strength and optical characteristics better than that of paper produced from regularly kraft pulped eucalyptus wood.

As has been delineated above, the results of biopulping techniques on different species of wood, using different species of fungi, is of an unpredictable nature. As Dr. Akhtar stated in his Declaration:

> "Given present standards of technology in the present understanding of the complex interaction of lignin and cellulose, it is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of energy savings achieved through such a process." (See paragraph 9 of Akhtar Declaration).

None of the cited prior art references contain any empirical teaching as to the use of eucalyptus wood in a biokraft process to make a paper pulp. Additionally, if, as the Examiner is indicating in the Office Action, it would have been obvious from the cited references to use a kraft pulping process with a biopulping procedure to obtain quality paper of any wood at a reduced energy cost, one would expect that the biokraft pulping procedure of the present invention would produce quality paper, at a low energy cost, using loblolly pine and aspen (the species specifically taught in the '564 patent). However, as discussed in the Akhtar Declaration, Applicants have shown that such a biokraft pulping procedure does not lead to differences in paper quality and energy cost when loblolly pine and aspen is used. The Akhtar Declaration discloses that:

> "Using similar methods of the present invention, I performed a biokraft pulping process on loblolly pine chips. Loblolly pine chips of standard size were obtained from Union Camp Corporation, Alabama. The chips were then treated with *C. subvermispora* and incubated for two weeks. The cooking conditions are mentioned in Table 1 (See attached Exhibit B). The process involved cooking the control and fungus treated chips with the pulping liquor (active alkali and sodium sulfide) for 120 minutes. The temperature was brought up to 171°C slowly in about 60 minutes, so that chemicals penetrated throughout the chips uniformly (ramp time), then the cooking was performed at 171°C for 60 minutes (cooking time). The effectiveness of fungal pretreatment was evaluated based on kappa number, yield, and physical and optical properties of the resulting paper

> after cooking. Kappa number and the physical properties of pulps were measured following the TAPPI standard methods. Results on pulp yield and kappa number with fungal pretreatments are shown in Table 1 (See Exhibit B). I used various concentrations of active alkali and fixed 25% sulfidity concentration in the experiment. The alkali concentration in cooking liquor was varied along with cooking time in order to obtain pulps at various yields and kappa levels. In each experiment set up I tried to compare the advantage of using fungus-treated chips over the non-treated control chips in kraft pulping processes. The preliminary results showed no apparent advantage of using fungus-treated chips over the control chips in terms of pulp yield and kappa number. The mechanical and optical properties of pulps obtained at various cooking conditions are presented in Table 2 (See Exhibit C). I found no significant difference in the properties of the pulp produced from control chips and fungus-treated chips cooked under identical conditions. The use of the white rot fungus species *Phanerochaete chrysosporium* on loblolly pine also have not shown any appreciable significant results with the kraft pulping process." See paragraph 16 of the Akhtar Declaration. Emphasis added.

Given this disclosure, one skilled in the art would assume that a biokraft pulping procedure would not produce paper of any significant difference in quality or energy cost than that of paper made from standard kraft pulping procedures. Applicants, however, found surprisingly unexpected results when using their biokraft procedure with eucalyptus wood in that the paper produced from such a method has better strength and optical characteristics than that of paper produced using a simple kraft pulping procedure. Additionally, the paper is produced at a lesser energy cost. The Akhtar Declaration sets forth that:

> "Based on the biokraft pulping experiments on loblolly pine and aspen, it was expected that the biokraft pulping of eucalyptus would produce similar results (i.e. no significant difference between the properties of the pulp produced from the control chips and the fungus-treated chips) however, when the method of the present invention is utilized with eucalyptus wood chips, unexpected results are achieved. The biokraft pulping method used with eucalyptus wood results in improved chemical pulping efficiency and pulp properties (brightness and strength). An experiment as set forth in Example 1 of the specification was performed using the white rot fungus species *Phanerochaete chrysosporium* (see pg. 13-15 of the specification. A biokraft eucalyptus pulp is compared to that of a control which was not treated by *Phanerochaete chrysosporium*. The unbleached brightness and the final brightness of the biokraft eucalyptus pulp is higher than that of the control pulp (See Table 13(a) on page 45). Additionally, the strength properties of the treated eucalyptus chips are greatly improved (See Table 13(b) on page 47 of the Specification). Furthermore, the beating time of the kraft process utilizing biotreated eucalyptus wood is reduced by 33%. Another unexpected result is that the improved characteristics of the biokraft eucalyptus

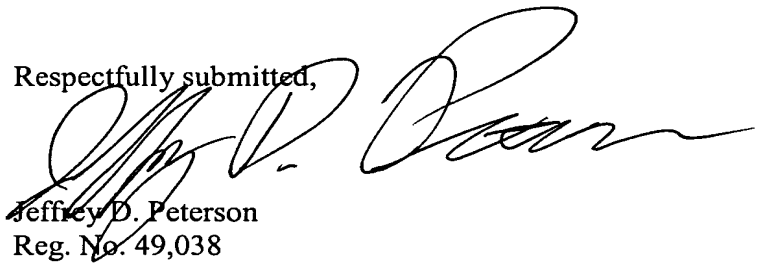
pulp is maintained without the addition of nutrients (specifically corn steep liquor) to the biotreated eucalyptus wood chips. Eucalyptus wood is very unique giving better results both with and without corn steep liquor. Such remarkable results have not been cited or suggested in the prior art with any other wood species tested." See paragraph 18 of the Akhtar Declaration.

For reasons set forth hereinabove, therefore, Applicants respectfully submit that the methods of the present invention, and the biotreated eucalyptus wood chips provided by the methods, would not have been obvious to one of ordinary skill in the art at the time the invention was made. Specifically, the presently-claimed methods produce results which would have been surprising and unexpected to one of ordinary skill in the art at the time the invention was made, or even at the time the present application was filed. In view of the above, therefore, applicants respectfully request the withdrawal of the rejection of claims 1, 2, 4 and 12-17 under 35 U.S.C. § 103(a).

SUMMARY

Based on the foregoing, Applicants respectfully submit that the present application is in condition for allowance, and a favorable action thereon is respectfully requested. Should the Examiner feel that any other point requires consideration or that the form of the claims can be improved, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



Jeffrey D. Peterson
Reg. No. 49,038

Docket No.: 016260-9005-02
Michael Best & Friedrich LLP
One South Pinckney Street
P. O. Box 1806
Madison, WI 53701-1806
608.257.3501